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# JPRS Report

# Science & Technology

## China: Energy

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# SCIENCE & TECHNOLOGY

# CHINA: ENERGY

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/12223

# ECONOMICS, ENVIRONMENTAL IMPACT OF THREE GORGES QUESTIONED

HK131530 Beijing QUNYAN in Chinese No 2, 7 Feb 87 pp 28-29

[Article by Huang Wanli (7806 8001 6849): "How Should We Decide Whether To Build the Three Gorges Dam"--the author is a professor at the Water Conservancy Department of Qinghua University]

[Text] Introduction

The construction of the Three Gorges dam on the Chang Jiang is a gigantic project with a huge anticipated benefit: After its completion it will exert a tremendous influence on the national economy from such aspects as electricity supply, shipping, and flood prevention. This is a multipurpose project. Being a major item in the overall plan for the water conservancy and economy in the Chang Jiang basin, it should naturally be brought into line with the state economic plan. For this reason, when considering the construction of this gigantic project, we should study not only all aspects of its feasibility but also its feasibility in comparison with similar projects in the same economic area and the same river valley, as well as the state economic plan. That is to say, while taking the feasibility of the project as an indispensable condition, we should also require it to have a higher value than other similar projects to warrant giving rational priority to its construction.

When planning for the construction of the project 40 years ago, the first thing people worried about was the technological problems involved. The generating power of the Three Gorges dam is more than 10 times greater than that of the Hoover dam in the United States, the biggest dam in the world when it was completed half a century ago. However, with the great progress in building technology, the Hoover dam pales into insignificance in comparison with the Three Gorges dam. In the 1940's the United States worked out a water conservancy plan for the Tennessee River valley. Because the river flowed through several states and because all states had independent laws, President Roosevelt, in an effort to realize this great multipurpose project, called on Congress to formulate a law and set up the Tennessee Valley Authority, which proved quite successful. At that time, many people in our country held that in building the Three Gorges dam on the Chang Jiang we should also set up a Chang Jiang Valley Authority.

Actually, although our country is divided into many administrative areas, it has a unified law. Even though the flooded man-made lake behind the big dam covers a large area, there are always ways to solve the numerous political problems, such as losses and compensations. For this reason, technology and politics are unlikely to play a negative role in the construction of the Three Gorges dam.

The crucial question of whether or not the Three Gorges dam should be built lies in whether or not it will exert an unfavorable effect on the hydrological landforms (coming under natural geography) in the entire river valley after the dam is completed. It lies too in the excessively high cost of the big dam and the long time needed for the completion of the project, making the cost of its per-unit power much higher than other large and medium-sized hydroelectric power stations and thus calling its economic feasibility into question. It also lies in the difficult problem posed to national defense by the big dam and big reservoir. These three points determine that the big dam should not be built and no future changes in the environment can easily establish its feasibility.

Arguments Against the Construction of the Three Gorges Dam

There are three arguments against the building of the Three Gorges dam in the Chang Jiang. First, viewed from the angle of natural geography or hydrography, the dam will have an unfavorable effect on the landforms in the upper and lower reaches: The river's silt flow will be cut off for 100-200 years, the pebble flow at thebottom of the river will be blocked forever, and the pebble will sink to one end of the reservoir. In the upper reaches, the sediment will gradually spread upwards and, after crossing Hechuan and Luzhou, stretch into various tributaries, raising the riverbeds. When there is a flood, it will inundate the fields on both sides of the river and start a new orogenic movement. Meanwhile, the sand and stones will not sink in large quantities to the depths of the reservoir. This is the fatal weakness of the big dam. We do not know how much silt and pebble will roll down. Nor do we know the service life of the dam because we have been able to calculate the sand in the river but not the pebble flow at the bottom of the river. In the more robust years of my life, I walked along the banks in the upper and middle reaches of the river. I travelled over 3,000 km in 4 years, observing the high and precipitous cliffs on both sides of the river. When the clear water was less than 1 meter deep, I could see everything moving on the bottom of the river. When the river rose after a rain, the water looked turbid but the pebbles at the bottom of the river moved faster. Where do the sand and stone flow? If they stop on the way, the various tributaries, such as the Min Jiang and Pei Jiang, should silt up and the flood water in the Chengdu plain rise, but they do not. Then, the sand and stone can only flow down the river, pass the three gorges, and sink at the bottom of the Jing Jiang. Because of the big dam, the sand and stone cannot flow out of Sichuan but will stay in and around Hechuan and Luzhou.

In the history of geology, the alluvial plains in Hubei, Hunan, Jiangsi, Anhui, and Jiangsu come from the alluvial silt and pebble mentioned above, which are still constantly building up sand banks in northern Jiangsu and in Shanghai's Pudong and stretching the river mouth to the sea. Ding Wenjiang estimated many years ago that the mouth of the Chang Jiang grows by 1 mile every 60-70 years. If you look at the map published in 1930 you will not find four northern Jiangsu counties, namely Sheyang, Dafeng, Rudong, and Qidong. It is estimated that at least 300,000 mu of land is created in eastern Jiangsu every year and it is the Chang Jiang that has moved this wealth from Sichuan to Jiangsu. If the Three Gorges dam is built, the coastline will not stretch outward. On the contrary, it will retreat as a result of pressure from the waves.

If the dam is built, the silt flow will be blocked, raising floodwaters in the upper reaches and causing frequent floods; not only will the land area stop growing in the lower reaches but the beaches will also be eroded. That is why so many countries have stopped building dams across rivers. For example, Brazil has shelved all plans to built 25 dams across the Amazon. In Malaysia, the people throughout the country oppose the building of the dam in Sarawak, which will cost $4 billion. India has stopped building the (Sailunt) dam, which it started 8 years ago. Australia has cancelled plans to build a dam on the Franklin River in Tasmania. A dam built across a river can be used to generate electricity but it can also affect landforms and jeopardize the environment. For this reason, people usually use hydraulic power to generate electricity at the source of a river to prevent the dam from causing obvious harm or utilize thermal or atomic power instead.

Second, from the economic point of view, the cost of 1 kilowatt-hour of electricity generated from the Three Gorges dam is very high and it will take 17 years to complete this project. It might be better if we build a succession of large and medium-size power stations with a capacity of 0.5-1 million kilowatts. With a rate of building one power station every 5 years, we can recover the capital every year and achieve better economic results. General economic knowledge shows that doing business in a small way is more profitable than making long-term investments with slow economic returns because the former can recover the capital more quickly. Moreover, there will only be capital input and no capital recovery in the Three Gorges dam before the year 2000. It obviously does not contribute to the objective of quadrupling the gross value of industrial and agricultural products if there is only consumption but no contribution.

Third, viewed from national defense, the dam undoubtedly represents our weak point in the face of the enemy. If the power stations are destroyed, the industries in Central China will be paralyzed; if the dam is destroyed, the people in the five provinces will be drowned.

We can thus see that it is not feasible to build the Three Gorges dam.

General Knowledge of Project Steps

Although it is inadvisable to build a super-dam, there are many typical examples of technically sound and economically perfect big dams, such as the Wu Jiang power station. There are favorable natural conditions for building such big dams in various southwestern Chinese provinces but we have done few general surveys so far. Why not transfer the 11,000 or so experienced technicians who are investigating the Three Gorges project for 6 months to conduct surveys there and provide many technical and economic reports?

The steps for carrying out a construction project include decision-making, planning, design, construction, and operation. Here, design refers to detailed plans, complete with drawings used in construction. This step may cost a lot of money, accounting for between 0.1-0.3 percent of the project cost. A large construction project at a cost of 10 billion yuan may need 10 million yuan for designing and a small building project at a cost of 10 million yuan may also need 300,000 yuan. To achieve the same purpose, we should compare many project designs. However, it will be a great waste if we make detailed designs which may not be adopted in the long run. A rational step is to make a simple preliminary design first. Called an estimated survey budget in the early years, the preliminary design costs little money. By walking at a speed of 10 km a day on many routes, a railway or highway engineer can give approximate figures for the size, investment, and operational expenses of the project for each route, as well as the annual returns, with an error of less than 15 percent. We can thus calculate the economic returns of the project for each route and, after making a comparison, decide which to use. Only after we decide the tentative plan for a project and raise the necessary funds do we organize a large number of people to do detailed designing on the plan. The preliminary designing must be conducted by a fully experienced chief engineer, who has the ability to do a concentrated amount of very ingenious work. These are included in the planning stage. The planning should also be subordinated to a certain general plan, which is decided in advance by a think tank. What I have discussed in the previous paragraphs comes under the category of a general plan.

In the decision-making and planning stage, the amount of work is much smaller than the following steps but a high degree of scientific and technological knowledge and ability is needed. With regard to every plan, it is necessary to determine its feasibility from various aspects, such as the natural, technical, political, economic, and international conditions. If all plans are feasible, it will then be necessary to decide upon the best one so that funds can be raised to do detailed designing.

We can thus see that in carrying out a project, the first tactical work and the feasibility studies at the planning stage are brief but sophisticated. They need neither many people nor a lot of money. Only after we establish its feasibility and choose a tentative plan do we need many people to do the designing and carry out the construction. It is hoped that leaders at all levels will take into consideration the project steps discussed here so that China's limited technological forces can be rationally used.

/9604
CSO: 4013/68

STATE AGENCY TO BREAK COAL EXPORT MONOPOLY

HK210245 Hong Kong SOUTH CHINA MORNING POST (BUSINESS POST) in English 21 Apr 87 pp 1, 2

[Article by Olivia Sin, recently in Beijing]

[Text] Beijing recently gave a low-profile state corporation formed by business veterans approval to handle coal exports, breaking the monopoly of the China National Coal Import and Export Corp.

The special trading right went to the one year old China Industry and Commerce Development Corp (INCOMIC), set up under the auspices of the All China Federation of Industry and Commerce.

Observers said the move could be viewed as a step by China to instill some competition into the country's rigid foreign trade system dominated by the specialised state trading agents. The approval was given a few weeks ago and INCOMIC vice-president Hu Zhengqing said the company has sent trading delegations to Hong Kong to start the coal trading business.

"Through some middlemen in Hong Kong, we have conducted small volume of coal trading already," he said. "Beijing has imposed no restriction on us... We are allowed to export as much as we can source and the market can absorb."

Mr Hu said the company had built up strong connections with coal producing provinces such as Shanxi, Henan, Guizhou and Shandong to obtain supplies of high quality coal.

China, one of the world's top coal producers, exported only about 10 million tonnes of coal last year. But the country is determined to triple the amount by 1990 to generate more precious foreign exchange.

INCOMIC is a diversified state agency involved in trading, consultancy, investment and is responsible for facilitating the country's absorption of foreign funds and technology. Its scope of business is similar to that of high-flying group such as China International Trust and Investment Corp [CITIC] and China Everbright Holding Co., except that the latter two are allowed to conduct foreign exchange and finance dealings. All three are directly controlled by the State Council and have a high degree of autonomy in business dealings.

INCOMIC, established in March last year with a registered capital of 100 million yuan (about HK$210 million) probably has a lot to learn from its two "big brothers." Nevertheless, INCOMIC has promising growth potential since it is backed up by an extensive network of contacts built up through the regional branches of its parent, the All China Federation of Industry and Commerce.

The federation comprises many so-called former "capitalists" such as the chairmen of CITIC and Everbright, Rong Yiren and Wang Guangying, as well as a new generation of industrialists and entrepreneurs.

"CITIC was set up much earlier and it has gained a lot of support, but we came in rather late," Mr Hu said. He said the company planned to set up a finance house to help the company grow, although he said it would take time to find enough capital and talent to operate such a business.

CITIC has set up an industrial bank in Beijing while Everbright has formed a finance company in the capital.

INCOMIC was given approval in September to import and export products, except those monopolised by the various specialised national trading agencies. The company is keen to expand its trading business and to make full use of its regional "connections" to obtain supplies.

Mr Hu said the All China Federation of Industry and Commerce has set up more than 900 enterprises in various places engaged in manufacturing and trading.

Last year INCOMIC exported wood, marble, granite and chemicals such as sulphur. It has also imported wool worth millions of U.S. dollars to satisfy the need of domestic industries.

The All China Federation of Industry and Commerce is part of the Chinese People's Political Consultative Conference, a powerful advisory body to the Chinese Government.

INCOMIC is taking part for the first time in the Guangzhou Trade Fair, which opened last Wednesday. Mr Hu said INCOMIC hopes to join the autumn trade fair as a separate delegation so that it can send more representatives and obtain more display area.

Before we are allowed to do that, we have to achieve an annual export volume of US$100 million and we have to work harder," he said. On foreign trade reform, Mr Hu said he hoped it would give more freedom to regions to trade directly with outside world. "The central government is keeping too tight a grip on foreign trade, and there is little incentive for the regions to work hard," he said.

On the other hand, China is adamant that the export of key items will remain centralised to avoid various trading units undercutting each other and hurting the national revenue.

China put off the trade reform till next year and there are several debates on how the reform should be carried out. Nevertheless, INCOMIC is equipped with

a number of business veterans who are committed to steer the company ahead despite all the limitations.

Among its senior executives are some who have served or are currently serving the Ministry of Foreign Economic Relations and Trade, MOFERT.

Mr Hu himself is the former deputy director of the Institute of International Studies of the Ministry of Foreign Affairs, in charge of U.S. studies.

INCOMIC has also made inroads into the consultancy business. "Many foreign companies have signed consultancy agreements with us to tap our extensive regional network," he said. "We help them to look for joint venture partners, search for new projects or straighten out problems in business negotiation."

Its long list of clients includes General Electric of the United States, Union Carbide, Bank Indosuez, General Motors and American Combustion Engineering.

A number of Japanese firms have signed co-operative agreements with INCOMIC including Mitsubishi Bank, Marubeni and C. Itoh.

INCOMIC has also joined hands with a French firm to set up a winery in China to make dry white wine.

Mr Hu said the state Council has given the company approval to set up a representative office in Hong Kong. "But time is not yet ripe for us to set up an office," he said.

/12913
CSO: 4010/43

# REGIONAL POWER DISPATCHING AUTOMATION IN CHINA REVIEWED

Nanjing DIANLI XITONG ZIDONGHUA [AUTOMATION OF ELECTRIC POWER SYSTEMS] in Chinese Vol 11, No 2, Mar 87 pp 3-8

[Article by Pei Zhongdi [5952 6988 2769]]

[Text] Abstract: After a brief introduction of the state-of-the-art regional power dispatching automation (RPDA), the paper gives the author's view on the development of RPDA in China and discusses: 1) The planning of RPDA in China, 2) the needed functions and technical requirements of China's RPDA, and 3) two important problems in the implementation of China's RPDA--treating RPDA as a system engineering problem and attaching importance to the serviceability of RPDA.

I. Regional power dispatching automation in China has gone through some rapid developments in recent years. About one-fourth of China's more than 200 regional power networks have developed or are preparing to develop dispatching automation of various scale and capability. Some of the automation are planned and implemented by the power network bureaus or provincial administrations and others are developed and implemented by the electric power supply units at their own expenses. Faced with the trend of a nationwide regional power dispatching automation, research institutes and manufacturing units of the Ministry of Water Resources and Electric Power have developed RPDA systems and microcomputer control terminals and are currently working on the production of serialized products and improving the product performance.

Among the dozens of regional dispatches engaged in RPDA, the Zhengzhou region is leading the way. Nanjing and Beijing regions have also made considerable achievements and improved their system performance. These results show that RPDA systems can contribute to the safety and economy of the power network. Of course, some of the RPDA systems are flawed due to various reasons and do not meet the application requirements. The benefits of these systems are hard to say. In addition to the remote control of the electrostatic capacitor, the Zhengzhou system is mainly characterized by the implementation of telecontrol, the accuracy of the measurement system, and the reliability of operation. Based on these, the Zhengzhou RPDA system has already used the remote control parameters in their production scheduling and operation analysis statistics. Naturally, it is only meeting the fundamental requirements of application, but it represents a step forward nonetheless.

In order to properly implement the regional power dispatching automation in the 7th FYP period, there must be a workable plan backed by the necessary funding and technical support. At the same time, there should also be a technical policy compatible with the current RPDA developments, a set of specific technical requirements and a supply of the associated software and hardware systems.

The target date for the full implementation of RPDA in China is set for the year 2000. By 1995 more than half of the regional power networks in China should have achieved some degree of safety monitoring. In August 1986 Deputy Minister Zhang Fengxiang [1728 7685 4382] of the Ministry of Water Resources and Electric Power proposed the following goals for the 7th FYP in the Third Working Conference on Computer Applications: To achieve computer monitoring in 6 power networks, 23 provinces, and 50 regional dispatch systems. In other words, each province should have computer controlled RPDA in one to two regions. A few provinces have now proposed goals that exceed or greatly exceed the automation of one to two regions, but some have also expressed the view that it would be a formidable task just automating one region per province. Conditions and capabilities certainly differ from province to province and there are also different views on the specific requirements of RPDA. In order to form a consensus, the Production Office and the Electric Power Dispatching and Communications Bureau of the ministry organized an investigative research group in August 1986. This group spent more than a month studying the production, supply, application and development of RPDA systems and investigated more than 40 research institutes, manufacturing bureaus, design institutes, and network dispatches. Immediately after, the Manufacturing Bureau, the Electric Power Dispatching and Communication Bureau, the Science and Technology Office, and the Production Bureau jointly held a meeting to discuss the investigation results on 15-18 September 1986 in Nanjing. The following technical documents were discussed and approved by the ministry at the meeting:

1. Performance specifications of RPDA.

2. Basic standards of RPDA systems.

3. Deployment requirements of RPDA systems.

4. Auxiliary installation of RPDA systems.

## II. Functions and Technical Requirements of RPDA

The functions and technical requirements are determined by the following considerations:

1. Feasibility of completing the RPDA system as a whole within the specified time period;

2. Feasibility of providing the necessary hardware and software;

3. Funding;

4. The cost, performance, and utility of the system.

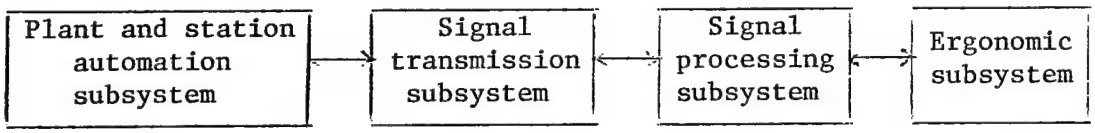
RPDA as a complete system consists of the following four subsystems:

1. Basic plant and station level automation subsystems;

2. Signal transmission subsystem;

3. Signal processing subsystem;

4. Man-machine subsystem.




(a) Electrical and nonelectrical measurement, control, and execution
(b) Telecontrol channels
(c) Computer data processing
(d) Computer system screen display, printer and simulation disk

All the power supply bureaus that have developed practical RPDA systems so far and received approval of the dispatchers and the technical leaders have given simultaneous consideration of the four subsystems above. The reasons that the Zhengzhou Power Supply Bureau was able to meet the requirements stated earlier in this paper are three-fold. First, they installed the necessary computer system. (In retrospect, the capabilities of their computer systems are not very high, in fact, they are less than or much less than the capabilities of the microcomputers now available to the users.) Second, they solved the channel and telecontrol installation problems. Third, they improved the accuracy of the measurement equipments in the substations. The Zhengzhou system is therefore a complete system with adequate signal and accuracy.

Of the four subsystems, the computer system is the heart of the network dispatch automation. Its development was later than the other subsystems and was essentially nonexistent before 1980. It is understandable that the emphasis of the 6th FYP was placed on the development of computers. The 6th FYP effort paved the way for the present complete microcomputer systems applicable in RPDA. Today the emphasis should be placed on the application of whole systems. It is imperative that a set of practical requirements be put forth for today's RPDA based on the experience of on-line computer applications acquired by dozens of dispatching units.

The final goal in installing an on-line computer monitoring system is to make use of its practical values. However, most of the power supply bureaus equipped with microcomputer systems are only using the data as references and not as a basis for production scheduling and statistics because the

data are either insufficient or not inaccurate enough. Although some of the problems stem from the microcomputer system, the main problem is in the quantity and quality of the signal transmission channels and the telecontrol devices. Efforts must be made to improve the accuracy of the output signals of the plants and stations and the reliability of the sensors.

Experience shows that extensive resources are required to maintain the accuracy of the data bus and the sensors and to keep the transducers calibrated. They account for most of the investment and operating costs. These activities should take place simultaneously or slightly before the installation of the computer system in the RPDA effort so that the practical utility of the system can be realized.

In the space below we shall discuss the basic functions and the technical requirements of RPDA in the 7th FYP. It should be pointed out that these requirements are only the first step toward the practical application and the utility must still be improved in the 8th and 9th FYP. We first discuss two fundamental general requirements in RPDA.

1. Utilization Rate of the System

As described earlier, a number of RPDA systems have already been built in China. Generally the dispatchers had an initial distrust of the system (mainly caused by the lack of reliability and accuracy of the systems) and were reluctant to use the systems due to a force of habit. Dispatchers in recent RPDA systems in northern China, eastern China, Shandong, and Zhengzhou have come to rely on the man-machine subsystem as an indispensable tool in power production operations. To meet the needs in production planning, there must be an indicator of the utilization rate of the automated system. It was proposed that the system utilization rate in a dual control system should be at least 99.8 percent. (A dual system is a system with cross-diagnostic and communication functions and has automatic switching capability.) This implies that there may be 17 hours out of a year when the system is not used. Although this system down time may be acceptable to the dispatchers considering the small probability that an accident may occur during this short down time, but any accidents that do occur in the 0.2 percent of down time can still cause great losses. The rate is tentatively set at 99.8 percent because the dual control system in regional dispatching is newly developed and insufficient experience has been acquired. As the reliability of the hardware is improved and more experience is accumulated, the rate will be raised to 99.9 to 99.95 percent.

2. Total Regional Power Load

One of the important functions of the power dispatch system is to assess the total regional power load. Since many regions suffer from power shortages, planned power usage must be practiced in order to ensure the frequency quality and the safe and stable operation of the power system. The rationing of the electric power is based on the total regional power load. Many regions today cannot practice power rationing because of the lack of data channels and telecontrol systems. In some regions the data cannot be trusted

because of large errors in data transmission and inaccuracies of measurement sensors. Under such circumstances the total regional power load data cannot be used in production planning and can only be used as a reference. It is now proposed that the automated control of the total power load should reach 90 percent. This is not a particularly high standard. Since the power system invariably contains some independent loads, lack of realtime data on these loads will not overly affect the operation of the entire system. Some power loads are not yet in a position to deliver realtime data and must be included in the 10 percent and controlled manually. To realize the 90-percent goal the power supply bureaus must ensure the accuracy of the installed data channels and telecontrol devices. In addition to the control rate for the total regional power load, the technical document also proposed a target for directly dispatched telecontrol of the substations. These two targets are interrelated; the former is the load covered by the signal and the latter refers to the number of telecontrol devices installed and their operation rate. In some regions with large power consumers the power loads may be concentrated and the 90-percent goal can be achieved with only a few data lines and telecontrol devices. The number of controls in these regions may fall far below 80 percent of the controls that should be installed in directly dispatched substations.

We now briefly discuss the other goals.

Measurement. The technical document stated that the overall error of the measurables should be no greater than ±1.5 percent and the remote measurement reliability should be above 98 percent. To reach these goals, the precision and accuracy of the signal transmission must be maintained. The accuracy of the transduction devices must be ensured. The power supply bureaus must pay attention to the regulations stipulated in the document entitled "Regulations on the Management of Telecontrol of Electrical Power Systems" that took effect on 1 January 1987. The control transduction belongs to the area of meter and instrument monitoring.

Switching. The document specified 99 percent and 99.99 percent reliability for remote signals and remote control respectively. The time resolution for event recording is set at 20 milliseconds or less. The time resolution standard was set at 20 ms because in regional dispatching systems the relay protection and switching times are of the order of a few cycles and any higher resolution requirements will require much higher investments in the automation system. Considering the actual facilities currently available in the regional dispatches, it makes sense to make the sequential recording an option. Due to insufficient auxiliary connections of the switches and relays, sequential recording would require the installations of a large amount of small cables, which is a major undertaking. From a performance cost ratio viewpoint, the recording function should not be extensively used in the regional networks at present time.

Screen display. The issues in screen display are the density of alphanumerics and Chinese character display. We realize that display screen, printer and simulation disk are the "windows" of an automated dispatch system. A dispatcher should make use of these ergonomic devices in assessing the realtime

data and other information of the network. Being the primary piece of the ergonomic devices, the display on the screen must be clear. Some of the display screens now used are modified television screens and do not work well. The display is entirely in Chinese in order to suit the worker's habits and to ensure accurate understanding of the messages and rapid reactions.

Telecontrol device. According to the document "Planning Goals and Standards for Network Dispatch Automation in China," both CDT and Polling are acceptable. Regions with the necessary resources may consider adapting the Polling system. Both systems are equipped with remote sensing and remote signal functions. When the time comes some regions may practice remote control of switching of certain loads and electrostatic capacitors.

Response time of system. This is an important function of the control system. The target response times for the transmission of the switch status, cross-region remote sensing, remote control and dispatching are less than 3-4 seconds. These response times will satisfy the actual needs of the regional dispatch automation and higher standards will be much more costly. The picture response time is set at 3 to 5 seconds. A response time longer than 3 seconds would appear too long to the operator and a shorter response time will require additional internal memory of the computer. (The response time of most commonly used graphical displays should not be longer than 2 seconds.)

## III. Two Problems in RPDA

### 1. System Approach to RPDA

As described earlier, the RPDA engineering may be divided basically into four subsystems: basic plant and station automation, signal transmission, signal processing, and man-machine system. Signal processing and man-machine ergonomics are in the realm of computer systems and the other two subsystems do not fall in the realm of on-line monitoring computer systems. Nonetheless they are part of the overall on-line monitoring system and the whole system will not be complete and cannot operate without any of the subsystems. Even with all the subsystems, the entire system still cannot be trusted by the operators if the signal accuracy of a certain step is questionable. Therefore, the RPDA engineering should be approached from a system viewpoint and the emphasis should be placed on practical utilization so that its presence can benefit production.

Based on our experience of the 6th FYP and the currently available technical expertise, equipments, and funding, microcomputer based RPDA in the 7th FYP should be possible and the targets may very well be exceeded. But it is much less optimistic in terms of the assurance of the quantity and quality of the signal channels and telecontrol and the accuracy of the transduction devices. It requires the collaboration of plants, stations and dispatch departments and the cooperation of the design, capital construction, technical improvement, and operations departments. In short, RPDA cannot be accomplished by the dispatch office alone, although it plays the main role

in the task. It needs the leadership of the superior office--the power supply bureau--of the regional dispatch system and a system approach. Its completion requires the joint effort of the various units in the bureau.

2. Practical Utilization of RPDA

The reason that RPDA is stressed as a system engineering project lies in the practical utilization purpose of RPDA. As was pointed out earlier in this paper, the main problem with the tens of RPDA systems today is that they failed to meet the practical needs even though they have sophisticated computer systems. The computer is the core of the entire system but it must be supported by the necessary software and hardware systems to carry out the planning of power dispatching. Still, the computer system (let alone a single computer) must be regarded as only part of the entire system and it is a major mistake to think only of computers whenever RPDA is mentioned. This misunderstanding is caused by a lack of appreciation of the practical value.

The practical utilization issue must receive the full attention of the leadership and the various departments in dispatching, research and the plants. During the 6th FYP period microcomputers were not developed enough to serve RPDA and the various functions in the automated dispatching were still being developed. After 5 years, especially the efforts in the last 2 years, microcomputer applications in RPDA have passed the research stage and entered the utilization stage. Serialized products are beginning to become available.

The 50 RPDA systems called for in the 7th FYP are all meant to be practical systems. The entire dispatch automation system should be certified at the same time the computer system is certified. We therefore make the following suggestion: If the accuracy of the signal channels, the telecontrol devices and the transduction system cannot be guaranteed, the acquisition of the computers should be delayed. Our effort is paid off only when every RPDA system put into operation is meeting the application requirements.

9698/6091
CSO: 4013/61

NORTHWEST POWER PLANNERS PROPOSE INVESTMENT-SAVING SCHEME

HK110529 Xining Qinghai Provincial Service in Mandarin 0430 GMT 11 May 87

[Text] The Northwest Prospecting and Design Institute of the Ministry of Water Resources and Electric Power has, in planning and designing the Longyangxia hydroelectricity project on the Huang He, proposed a study scheme that could save the state some 2 billion yuan in investment by linking up the northwest power grid with the north China and southwest grids for joint operations, with each making up for shortfalls in the others.

The institute put forward this scheme for study after analyzing and verifying the characteristics of these three major power grids. The characteristic of the northwest grid is its high proportion of hydroelectricity, while thermal power accounts for 94 percent of the power on the north China grid. After being linked up, these two major grids can fully display their own strong points and make up for each other's shortfalls.

If the northwest and southwest power grids are linked up with hydropower regulation spanning different river systems, Sichuan Province's installed hydroelectric generating capacity could be increased by 1.15 million kilowatts.

/8309
CSO: 4013/71

HUBEI AUTHORITIES FOCUS ON SOLUTIONS TO POWER SHORTAGE

HK301344 Wuhan Hubei Provincial Service in Mandarin 0900 GMT 28 Apr 87

[Excerpts] Several provincial CPPCC committeemen who are members of the scientific and technological group for power systems under the fifth session of the fifth provincial CPPCC committee this morning invited journalists to attend a forum on ways to ease Hubei's power shortages. They called for adopting measures to prevent a situation in which electric power produced by the Gezhouba power station lies idle during peak periods in water supply while the eastern part of Hubei Province is seriously short of electric power.

The committee members said: Over the past few years, there has been relatively quick development of Hubei's power industry. However, the power growth rate is far from keeping pace with the rapid industrial and agricultural growth rates and the rapid growth rate of the people's daily power consumption. If an ample power supply could be ensured, our province's total industrial and agricultural output value could be increased by 20 to 30 percent.

The committee members said: to resolve Hubei's power shortage, the building of the second 500 kV transmission line that links Gezhouba with Wuhan and passes (Shuanghe) should be completed as quickly as possible. Second, construction of the (Hanchuan) power plant should be accelerated. Third, the beneficial results of existing generating units must be improved.

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CSO: 4013/71

NEW THERMAL, HYDRO CAPACITY TO EASE GUANGDONG'S POWER SHORTAGE

OW071802 Beijing XINHUA in English 1501 GMT 7 May 87

[Text] Guangzhou, 7 May (XINHUA)--The power shortage is expected to be eased next year in south China's Guangdong Province when power generating units with a combined capacity of 1 million kW is put into operation this year.

The director of the provincial planning commission, He Xian, said this will ensure a sustained steady economic growth in the province.

Electricity shortages have plagued the province for a long time and in 1986 a rare drought brought hydroelectric power output down by 8.1 percent. Every year it has to import more than 1 billion kWh of electricity from Hong Kong and share part of electricity from Guangxi.

The province plans to start building large and medium-sized hydroelectric and thermal power stations with a total capacity of 2.35 million kW and medium-sized and small hydroelectric power stations with a combined capacity of 140,000 kW this year. Of these, 1 million kW in coal-fired generating units are expected to go into operation by the end of this year.

All the projects will require an investment of 1.63 billion yuan. The province earmarked 580 million yuan on top of the investment committed by the central government and overseas business people.

The province hopes to produce 21.5 billion kWh of electricity this year, an increase of 13 percent over 1986.

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CSO: 4010/48

SICHUAN ADDRESSES SEVERE ENERGY SHORTFALL

HK270149 Chengdu Sichuan Provincial Service in Mandarin 2330 GMT 26 Apr 87

[Excerpts] The Fifth Session of the Sixth Provincial People's Congress held its second press conference on 26 April. Vice Governor Pu Haiqing and responsible comrades of the petroleum, electric power, coal, communications, and posts and telecommunications departments answered newsmen's questions on energy and transportation issues in Sichuan. A total of 63 reporters from central press units in Sichuan and 23 provincial and city press units attended the conference.

Pu Haiqing first gave a basic introduction on the energy and communications situation in the province. He said: Energy and communications in Sichuan have developed to a considerable degree since the founding of the state. This has contributed to the development of industry and agriculture and the improvement of living standards. However, due to various reasons, energy and transportation construction in the province is still unable to keep up with the requirements of the development of industrial and agricultural production and of improving living standards. There is a current shortage of electric power, natural gas, communications, and posts and telecommunications, and there is a serious imbalance between supply and demand.

Doing a good job in energy construction, especially in the electric power industry, is the fundamental way to change the situation of energy shortage in Sichuan, and is also a key measure for developing production. This year we plan to add an installed generating capacity of 450,000 kilowatts. There will be bigger increases in subsequent years.

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CSO: 4013/72

THREE POWER FACILITIES PLANNED FOR BEIJING MUNICIPALITY

HK060858 Beijing CHINA DAILY in English 6 Jun 87 p 3

[Article by staff reporter Xu Yuanchao]

[Summary] Construction of three power facilities with a total capacity of 2,100 MW will start during the current 5-Year Plan in a bid to ease Beijing's chronic power shortage.

They include a 600 MW thermal power plant in Gaobeidian, in the eastern suburbs, a 600 MW thermal power plant in Pinggu County and a 900 MW hydropower station near the Ming Tombs a spokesman from the Ministry of Water Resources and Electric Power said yesterday.

Chen Kai of the ministry's power planning division told CHINA DAILY the city's power capacity will increase to 4,000 MW more than double the current capacity, when the three are completed in the Eighth Five-Year Plan.

Chen said Beijing began to buy electricity a few years ago from Shanxi Province, which is expected to supply 3 billion kWh to Beijing this year. The province sold 1.8 billion kWh of electricity to Beijing and Tianjin in 1986.

The ministry will divert water from the Juma River to a coal burning plant in Gaobeidian through a 50 km channel if a current plan to supplying ground water to the plant proves impossible.

The hydropower station near the Ming Tombs will be a regulating reservoir to store water in normal times and generate electricity to supply the city in peak-load hours, he said.

At the Pinggu County plant, the ministry hopes to use water from a small river, 10 kilometers away, for the cooling system. If this fails, it is planned to change the system design to use wind, rather than water, for cooling.

Meanwhile, local governments in East China funded the installation of power-generating equipment with a total capacity of 352,000 kilowatts last year, greatly easing power shortages in the area.

This year, local governments in Jiangsu, Anhui, and Zhejiang provinces and Shanghai municipality in East China, which share electricity from the East China grid, will fund projects that can add 3.212 billion kWh of electricity to the grid, according to local officials.

CSO: 4010/51

## BRIEFS

YUNNAN POWER OUTPUT UP--In April [1987], the Yunnan provincial power bureau's electric energy output reached 626 million kilowatt-hours, an increase of about 15 percent compared with the same period last year. During the first 10-day period of May this year, the bureau's electric energy production output increased by 21.7 percent compared with the same period last year. [Summary] [Kunming Yunnan Provincial Service in Mandarin 1000 GMT 14 May 87 HK] /8309

CSO: 4013/71

## NEED TO CONCENTRATE ON HYDROPOWER DEVELOPMENT STRESSED

HK101236 Beijing RENMIN RIBAO in Chinese 3 Apr 87 p 5

[Article by Song Zemin (1345 3419 2404): "Striving To Promote Development of Hydropower Industry"]

[Text] Waterpower resources are high-quality energy resources that do not pollute the environment, are renewable, and do not cost much to exploit. Many countries give priority to the development of the hydropower industry. China has a reserve of 676 million kW of waterpower resources of which 379 million kW can be exploited, ranking first in the world. However, we have only exploited a little more than 4 percent so far and have failed to extricate ourselves from the passive state of "a country rich in waterpower resources but poor in electricity." Why? The traditional economic structure and ideas have hindered the development of the hydropower industry.

1. The cheap price of coal has depreciated the economic results of hydropower.

As the price of coal was 20 yuan or so per ton in the past, state-owned mines suffered a deficit of around 400 million yuan in 1985. The main feature of hydropower is that it can generate power to replace coal. Since coal is cheap it will be difficult to see the economic results of hydropower. However, the export price of coal is over $20 per ton. The efficiency of hydropower would be relatively high if calculated according to this price. The cost of generating 1 kilowatt of electricity by a hydropower station is around 1,700 yuan, 900 yuan more than a thermal power plant. The amount of coal saved every year is worth only 270 yuan. The excessive amount of investment can be returned in 3 years' time. The loans, including interest, can be repayed within 10 years. The life-span of a hydropower station is around 100 years. After repaying the debts, a net profit can be made in the remaining 90 years. Obviously, it is worthwhile to develop hydropower.

2. The irrational price structure of electricity and the same price charged for electricity during peak and average periods depreciate the peak load efficiency of hydropower.

Traditional ideas hold that consumption of electricity should be calculated according to the meter reading. As a result, the electricity charges are the same whether consumed during the peak period (load) or at other times.

In light of the concept of a commodity economy, the price of a commodity should be different according to its varying quality and functions. Similarly, the system of charging fees according to different hours of the day should also be implemented in the commodity of electricity because every household switches on the lights and television sets during the peak period (1900 to 2300 hours) and switches them off after that. As the facilities for generating and supplying electricity are used during this period, the loans and interests to be repayed for these facilities and the maintenance charges should be shared by these customers. Electricity consumption during peak periods is short, around 20,000 kWh annually in the capacity of 1 kW, while consumption of electricity during average periods is long, around 60,000 kWh annually. Therefore, the price of every kWh of electricity during the peak period should be higher than that during the average period. When a thermal power plant bears the peak load, it usually leads to problems such as machine failure, short service life, huge maintenance costs, and high coal consumption. For this reason, a hydropower station bears the peak load wherever available. If the price of electricity during the peak period is the same as that during the average period, the efficiency of hydropower in bearing the peak load is denied and hydropower is regarded as inefficient and generating less electricity even though it undertakes the heavy load. Apparently, it would be unfair to hold such a viewpoint.

3. The irrational calculation of investment depreciates the economic results of hydropower.

Apart from generating electricity, hydropower can also play a role in flood prevention, irrigation, and water supply. As investment in these fields is not shared by the relevant departments, investment in hydropower increases correspondingly. If the departments concerned undertook investment in flood prevention and irrigation, the actual investment in hydropower would be reduced.

Thermal power causes serious environmental pollution. To install environmental protection devices, an additional investment of 300 yuan will be required for 1 kW of electricity.

Viewed from the departments of power, a thermal power plant requires an investment of 800 yuan for 1 kW of electricity. But a hydropower station requires an investment of 1,700 yuan, 100 percent higher than a thermal power plant. Viewed from the point of view of society, a thermal power plant consumes 3 tons of coal annually for 1 kW of electricity. In addition, an investment of 600 yuan should be made in coal mines and 300 yuan for environmental protection. The total investment amounts to 1,700 yuan, which is the same as that of a hydropower station. Therefore, we should change the idea of "investment in hydropower being 100 percent higher than that of thermal power."

To develop thermal power and hydropower in a coordinated manner, it is necessary to vigorously exploit hydropower. First, hydropower should be regarded as a primary energy resource like oil, coal, and gas rather than a secondary energy resource like thermal power. We should make rational use of energy resources, improve the energy structure, and exploit hydropower resources. We should understand that hydropower completes the process of exploitation of water resources and conversion into power. It is a combination of primary and secondary energy. Hydropower resources are renewable. But coal resources consumed in thermal power plants are not renewable, the more you consume the less the reserve. Moreover, we should consume coal sparingly because it is also an important material for the chemical industry. To make rational use of energy resources and improve the energy structure, we must give priority to the development of the hydropower industry.

Second, reform the price structure of electricity and realize its commercialization. The current unitary price system for electricity should be changed to a system of setting varying prices for electricity consumed during different hours of the day, such as setting a high price for the peak period, an average price for the daytime, and a low price for the off-peak period so that different customers will reasonably share the charges. By doing so, we can guide customers to select the time that they consume electricity to reduce the load at peak periods. We can also promote the development of hydropower stations and pumped storage power stations and ease the shortage of electricity and limit use of electricity during the peak period. In places with abundant water resources, we can also apply seasonal price differences, such as increasing the price during the dry season and reducing the price during the rainy season, and realize the commercialization of electricity in an all-round way.

Third, we should turn the joint operation of exploiting hydropower and selling electricity into diversified operations so as to promote the development of the local economy. Experience at home and abroad has proved that exploitation of hydropower can give impetus to the development of the regional economy. Therefore, the economically backward areas with abundant water resources should regard hydropower as a point of breakthrough and make the most of cheap hydropower resources to attract high energy-consuming industries to run power plants and correspondingly develop some processing industries to intensively process raw materials. It is an excellent development strategy to give impetus to the development of the regional economy by transforming the superiority of resources into superiority of commodity. Take the development of hydropower to smelt aluminium for example. One ton of aluminium which costs 2,700 yuan, can turn out aluminium products worth over 20,000 yuan. With an additional investment of 100 percent, we can get a 300 to 400 percent increase of output value and profits. The impetus for a regional economy is quite obvious. Regarding the exploitation of China's western region, it is all the more important to develop the hydropower industry.

The development of the hydropower industry is an undertaking related to the building of socialist modernization and to the happiness of our future generations. If we start now and continue to make efforts for several decades, and if the extent of our exploitation can reach 25 percent, we will be able to save 250 million tons of coal annually, which will be of great significance to conserving coal resources, alleviating the pressure on railway transport, and reducing environmental pollution.

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CSO: 4013/66

HYDROPOWER CONSTRUCTION SAID ON EVE OF GREAT DEVELOPMENT

HK270905 Hong Kong LIAOWANG OVERSEAS EDITION in Chinese No 16, 20 Apr 87 pp 10, 11

[Article by Ye Du (6851 3256): "The Strategic Concept of China's Hydropower Development"]

[Excerpts] China's hydropower construction will probably enter a period of great development. This year, new generating sets with a total capacity of 1.8 million kilowatts are scheduled to go into operation and the nation's generated hydropower will probably top 10 million kilowatt-hours. The development of hydropower resources, called "white coal" by many people, is attracting greater attention.

China Ranks First in the World in Hydropower Resources but They Are Unevenly Distributed

Since the 1950's, China has conducted three nationwide surveys on hydropower resources, the latest being conducted from 1977 to 1980. On the basis of summing up the results of surveys and studies conducted in the past 30-odd years, the experts have applied advanced technology and methods in drawing a fairly comprehensive picture of our "resources."

It has now been ascertained through investigation that the theoretical reserves of China's hydropower resources is 676 million kilowatts for an annual generation of 5,000.09 billion kilowatt-hours. According to our existing capability, we can utilize 378 million kilowatts of resources, with an annual generated electricity of about 2,000 billion kilowatt-hours, accounting for about one-fifth of the annual generated electricity of the world's exploitable water power resources, ranking first in the world. The general distribution of these resources in various parts of the country is as follows: Most of the resources are concentrated in southwestern China, accounting for 67.8 percent; next are those in central south and northwestern China, accounting for 15.5 percent and 9.9 percent respectively; the resources in the three major regions of northern, northeastern, and eastern China add up to only 6.8 percent.

China ranks first in the world in hydropower resources but they are unevenly distributed. These are the two basic characteristics of China's hydropower resources.

## China Has Scored Major Successes in Construction but the Development Level Is Low

The use of hydropower to generate electricity was achieved in this century. In 1912, China's first hydroelectric power station, Shilongba hydroelectric power station, was completed at Tanglangchuan, which is situated at the mouth of the Dian Chi in the suburbs of Kunming. At first, it was fitted only with two hydroelectric generating sets with a capacity of 240 kilowatts each. In 1949, the installed capacity of all hydroelectric generating sets on the Chinese mainland was only 360,000 kilowatts, ranking 20th in the world, and China's annual generated energy was 1.2 billion kilowatt-hours, ranking 21st in the world.

China's hydroelectric power construction made considerable headway after the founding of New China. By the end of 1985, China had built 22 large hydropower stations, over 100 medium-sized hydropower stations, and over 80,000 small hydropower stations. Now, the installed capacity of hydroelectric generating sets on the Chinese mainland is about 30 million kilowatts and its annual generated energy exceeds 90 billion kilowatt-hours, heading the list for the world.

However, compared with the total exploitable hydropower in the country and with the exploitation levels in other countries, China's exploitation of hydropower is still relatively low. In the world today, all developed and developing countries give considerable priority to hydropower exploitation. The exploitation level exceeds 90 percent in France and Italy; 60 percent in West Germany, Norway, Japan, and Egypt; and 40 percent in the United States. Even India and Brazil, which started to expllit hydropower at a later date, have also reached 17 percent and 12 percent respectively. The exploitation level is less than 5 percent in China. Some major rivers have not been exploited. Many favorable river sections called "high-grade ore" of hydropower by people, such as the middle and upper reaches of the Huang He, Hongshui He, and Wu Jiang, are still far from fully exploited.

## Objectives and Plan

To achieve the economic and social development objectives by the end of this century, the relevant departments forecast that the installed capacity of China's generating sets must increase from over 92 million kilowatts at present to 250-270 million kilowatts in the year 2000, and the annual generated energy must increase from over 440 billion kilowatt-hours last year to 1,200-1,300 billion kilowatt-hours in the year 2000. If the construction of hydropower stations can develop simultaneously, their installed capacity will increase from about 27 million kilowatts now to 80 million kilowatts in the year 2000 and their annual generated energy from over 90 billion kilowatt-hours now to 230 billion kilowatt-hours in the year 2000.

In light of the distribution of China's hydropower resources and the future need to comprehensively tackle and use water resources, the experts have put forward a strategic plan for China's hydropower development and key projects for the next 10 years and more:

--The northwestern region. We should concentrate our forces on exploiting the river section from Longyangxia to Qingtongxia Gorge on the Huang He and build cascade hydropower stations at Longyangxia, Lijiaxia, Laxixia, Gongboxia, Daxia and Heishanxia; vigorously exploit the Bailong Jiang; develop the upper reaches of the Han Jiang to make them navigable; and concentrate on exploiting the Ili He and Kaidu He to make electricity readily available to Xinjiang. When all this is completed, the installed capacity of the hydropower stations in this region will exceed 10 million kilowatts.

--The southwestern China region. We should concentrate on exploiting the sections in which the water power is rich and concentrated, such as the Wu Jiang, Dadu He, Lancang Jiang, and Yalong Jiang, and build power stations at Dongfeng, Goupitan, and Hongjiadu on the Wu Jiang; cascade power stations at Tongjiezi and Nanyahe on the Dadu He; power stations at Manwan, Xiaowan, or Dachaoshan on the Lancang Jiang; and the Ertan power station on the Yalong Jiang. Moreover, we should vigorously develop the upper reaches of the Min Jiang and built cascade power stations on the Jialing Jiang in conjunction with the development of shipping. In Xizang, we should concentrate on exploiting the Lhasa He and vigorously develop small and medium-sized hydropower stations. By the end of this century, the installed capacity of these hydropower stations will exceed 16 million kilowatts, forming a gigantic power system extending to southwestern Sichuan, Yunnan, and Guizhou.

--The south China region. We should concentrate on developing the Hongshui He and building a high and low power station at Tianshengqiao in the Hongshui He and Nanpan Jiang, as well as cascade power stations at Yantan and Longtan. Moreover, we should develop the mainstream of the Xi Jiang and Yu Jiang. In Guangdong, we shall continue building medium-sized power stations and pumped-storage hydropower stations. By the year 2000, the installed capacity of these hydropower stations will reach 12 million kilowatts of which the installed capacity of large and medium-sized hydroelectric power stations will reach 8.4 million kilowatts.

--The central China region. We should speed up the construction at Gezhouba, Dongjiang, Wuqiangxi, and Wanan on the Chang Jiang, continue exploiting the mainstream and tributaries of the Chang Jiang, Yuan Jiang, and Gan Jiang; develop the Qing Jiang and Li Shui; and exploit the Xiang Jiang in conjunction with the development of shipping. We shall complete the hydroelectric power stations at Wuqiangxi, Lingjintan, Dongjiang, Yangheyan, Gaobazhou, Wanan, and Taihe before the year 2000 so that the installed capacity of the hydroelectric power stations in this region may exceed 15 million kilowatts. The Three Gorges hydroelectric power base is of great importance and we should therefore engage in active construction on the basis of conducting ample demonstration of its feasibility.

--The east China region. We should step up the building of hydroelectric power stations at Shuikou, Shaxikou, and Jinshuitan, the construction of which has either begun or will soon be started, and continue exploiting the Min Jiang in Fujian and the rivers in northeastern Fujian. In Zhejiang, we should develop some small and medium-sized power stations and build a pumped-storage hydroelectric power station at Tianhuangping. By the year 2000, the installed capacity of these hydroelectric power stations should reach 11 million kilowatts.

--The northeastern China region. We should continue exploiting the Di'er Songhua Jiang, exploit the Mudan Jiang and Nen Jiang, jointly exploit the Yalu Jiang with Korea, and vigorously develop pumped-storage hydroelectric power stations. By the year 2000, we should have been able to complete the second-phase Baishan hydroelectric power station, the multi-tiered Songjianghe hydropower station, and the hydroelectric power stations at Linjiang and Lianhuapao. The total installed capacity of these power stations should exceed 1.8 million kilowatts.

--The north China region. In conjunction with the use of water resources, we should pay close attention to the development of the northern trunk stream of the Huang He and vigorously build pumped-storage hydroelectric power stations. By the year 2000, we should have been able to finish the pumped-storage hydroelectric power station at Shisanling, as well as the power station at Wanjiazhai in the Huang He, with a total installed capacity of about 3 million kilowatts.

New Ideas for Speeding up Development

However, it will not be easy for China's hydroelectric power industry to achieve these objectives. For a long time, in its energy policy and investment distribution, China has "laid more stress on thermal power than on hydropower." Excessive state taxation on the hydroelectric power industry has deprived it of its ability to develop on its own. The experts have pointed out that it is necessary to effect the following changes in terms of understanding and system:

--It is necessary to place the returns of hydroelectric power on the background of China's socioeconomic development as a whole and allow the hydropower industry to make self-accumulation. In other words, we should not regard the hydropower industry as a direct means of financial accumulation but should divert the income to hydroelectric power construction. Through the development of the power industry, we should ease power shortages and bring about the development of the national economy as a whole, thus increasing the revenue of the state.

--With regard to the returns of hydropower projects, in addition to the generated energy, we should also consider the general efficiency from various aspects, such as flood prevention, irrigation, shipping, and aquatic production and thus open up channels for raising construction funds

on a large scale. That is to say, it is necessary to change the irrational situation of "everybody eating from the same big pot" in relation to hydropower projects and, in line with the principle that those who benefit should pay for it, formulate a rational policy for sharing investments.

--The modes of hydropower development, operations, and management should be changed from the previous administrative type to the economic one. That is to say, we should develop and operate hydroelectric power according to its special features and the law governing the commodity economy. A feasible practice at the moment is to organize different hydropower development companies according to drainage areas, river sections, or regions. In line with the principle of appropriately separating ownership from the power of operations, the state should provide these companies with the right to develop and operate rivers or river sections so that they can become relatively independent economic entities with full authority for their own management and full responsibility for their profits and losses.

Obviously, the hydroelectric power department cannot achieve these changes on its own. The state should formulate a series of policies to support it.

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CSO: 4013/68

SMALL STATIONS PLAY VITAL ROLE IN ELECTRIFICATION EFFORT

Beijing XINHUA in English 1538 GMT 4 Jun 87

[Text] Changsha, 4 Jun (XINHUA)--China's small hydropower stations have already acquired a combined capacity of more than 10 million kW, about one-third of the national total.

An official of the ministry of water resources and electric power told XINHUA that small hydropower stations generated 4.4 billion kWh last year, and one-third of all the counties now depend on them for electricity supply.

A small hydropower station usually has a capacity of less than 5,000 kW. China has rich water resources and it is estimated that 70 million kW can be developed for electricity production, and only 14 percent has been utilized so far.

The state council designated 100 counties in 1983 to pioneer a campaign for popularizing the use of electricity now 12 of them have realized the goal, with every resident consuming 200 kWh a year.

The small hydropower stations are adding 500,000 kW of generating capacity a year, and they are successful especially in remote mountainous areas. Even the remote Tibet Autonomous Region has built small hydropower stations with a total capacity of 98,000 kW.

In China's rural areas, due to short supply of electricity, peasants have to use large amounts of trees and grass as fuel, so that vegetation is destroyed and soil eroded.

In Cili County, Hunan Province, all of its 10,000 residents use electricity as their major energy source. Now the forest cover rate has risen to 35 percent from 28 percent just a few years ago.

CSO: 4010/51

EXPERTS DEEM LANCANG JIANG DEVELOPMENT PLAN 'FEASIBLE'

HK151250 Kunming Yunnan Provincial Service in Mandarin 1000 GMT 13 May 87

[Excerpts] From 25 April to 9 May, an investigative group of experts in water resources and electric power jointly organized by the Ministry of Water Resources and Electric Power and Yunnan Province, made an on-the-spot survey to examine the feasibility of a plan for developing water resources and electric power in the middle and lower reaches of the Lancang Jiang in Yunnan.

On 11 May, Zhu Kui, vice governor of the provincial government, called on the returned investigation group in Kunming on behalf of the provincial government.

The Lancang Jiang is very rich in water resources and there are very favorable conditions for exploiting water resources there. The Lancang Jiang is 1 of the 10 major bases on the PRC hydropower front. On the basis of its painstaking work over the past 30 years and more, the Kunming Survey and Design Institute under the Ministry of Water Resources and Electric Power has put forward a plan for building eight cascade power stations, including the Nanwan power station, on the middle and lower reaches of the Lancang Jiang with a total design installed capacity of more than 10 times the total installed capacity of the existing power stations in Yunnan.

After making the on-the-spot survey to examine the feasibility of the plan put forward by the Kunming Survey and Design Institute under the Ministry of Water Resources and Electric Power, experts of the group considered the institute's plan feasible and also noted that the middle and lower reaches of the Lancang Jiang are in a very advantageous position to become China's superior hydropower construction base.

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CSO: 4013/71

WORK ON 3000MW ERTAN PROJECT TO BEGIN SOON

OW221002 Beijing XINHUA in English 0937 GMT 22 May 87

[Excerpt] Beijing, 22 May (XINHUA)--China will start construction soon on the Ertan hydropower station in southwest China's Sichuan Province.

When running at full capacity, the station will have a capacity of 3,000 megawatts, making it the country's largest.

Ertan hydropower station will be able to put out 300,000 kilowatts more than the Gezhouba power station still under construction on the [Chang Jiang].

An official of the Ministry of Water Resources and Electric Power told XINHUA today, "The project will include a double-curvature arch dam, 240 meters tall, which will be tallest in China and the fourth tallest in the world."

The official also said, "The Chinese Government will earmark 3.7 billion yuan (U.S.$1 billion) and solicit foreign loans to build the project over the next 8 to 10 years."

"Construction of the Ertan station will be a major step forward in China's dam-building technology," the official explained, adding the project will benefit industrial and agricultural production in Sichuan Province, and particularly accelerate overall mineral resource development in the Dukou-Xichang area.

"This year, Sichuan Province will invest 40 million yuan (U.S.$10.8 million) to build highways and bridges for the project," he added.

The Ertan hydroelectric power project will be located in Sichuan's Yanpian and Miyi Counties, and will be next to Dukou's newly built iron-steel complex. Ertan is the first project to be implemented in the Yalong [Jiang] development plan.

The Yalong is 1,500 kilometers long and has a waterhead of 3,870 meters. With a hydropower potential of 25,000 megawatts, the river is one of China's 10 key hydropower bases.

Six generating units of 500 megawatts each will be installed in an underground powerhouse some 296 meters long, 24-31 meters wide, and 73 meters high.

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CSO: 4010/48

SURVEY RECONFIRMS HUGE HYDROPOWER POTENTIAL OF WU JIANG

OW220740 Beijing XINHUA in English 0651 GMT 22 May 87

[Summary] Beijing, 22 May (XINHUA)--The full utilization of China's Wu Jiang would promote the industrial and economic development of Guizhou and eastern Sichuan, today's overseas edition of PEOPLE'S DAILY reported.

In a recent 1-month survey covering a 2,300 km of the river, experts found the waterhead on 1,037 kilometers of the river's main section to be 2,124 meters.

Feasibility studies show that nine hydropower stations with a total capacity of 8.56 million kilowatts could be built in this area.

"If built, the stations could generate 42.12 billion kilowatts of electricity annually," the report said, "and assist in developing the area's nonferrous metals, building materials, machine building and electronics industries."

"China plans to shift development efforts to southwest China by the turn of the century," the paper said, adding that scientists from Beijing-based research institutes and a special group studying the river's potential have called the Wu Jiang one of China's three key hydropower reserves, comparable to the Huang He and the Hongshui He.

One station has already been built on the river, another is under construction and surveys for a third, with a capacity of 1.08 million kilowatts, have been completed.

According to the scientists, the stations will have to be located within a small area with an average investment of 1,400 yuan (U.S.$378) for every 1,000 kilowatts in capacity.

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CSO: 4010/48

## BRIEFS

WORK ON HUBEI'S GEHEYAN PROJECT--Wuhan, 20 May (XINHUA)--The upper part of the diversion tunnel for the Qing Jiang Geheyan hydroelectric power station, the largest power station of its kind in Asia, was completed this afternoon. The Qing Jiang Geheyan hydroelectric power station, another large-scale water conservancy project in the Chang Jiang Valley following the building of the Gezhouba hydroelectric power station, is situated in Hubei's Changyang County. The largest span of the diversion tunnel is 24.5 meters. It is 27 meters high with a total length of 650 meters. The linking of the diversion tunnel is a part of the early stage of preparation work for the whole project. The No 18 Engineering Bureau of the Ministry of Railways, which made remarkable contributions in diverting the Luan He to Tianjing and in the Daqing railroad construction, worked for less than 3 months in linking the upper portion of the diversion tunnel. [Excerpts] [Article by correspondent Lei Hanfa] [Beijing XINHUA Domestic Service in Chinese 1504 GMT 20 May 87] /9604

CSO: 4013/72

## LOCAL MINES PRODUCING OVER HALF OF NATIONAL TOTAL

OW101008 Beijing XINHUA in English 0942 GMT 10 May 87

[Text] Beijing, May 10 (XINHUA)--The mushrooming of locally run coal mines and pits has in recent years helped ease the strain of coal supply, a senior coal industry official said here today.

Speaking at a national meeting which opened here today, Hu Fuguo, vice-minister of coal industry, said that output of the locally run mines and pits increased at an annual rate of 11.8 percent in 1981-1985, and last year they cut 467 million tons of coal, accounting for 52.2 percent of the national total.

At present, coal accounts for about 70 percent of the country's energy resources.

China's coal industry depended mainly on the central government for investment before 1979 and almost 82 percent of 1980 output came from the state-owned mines.

But since 1981, the Chinese Government introduced a series of policies along with the economic reform, which encouraged local efforts to set up their own coal mines, and even allowed individuals to open pits while ensuring safety.

Statistics showed that in 1981-1985, local governments put in more than 4.9 billion yuan (about 1.3 billion U.S. dollars) in the field and now the country has as many as 65,000 locally run coal mines and pits.

There are now 285 counties each producing more than 300,000 tons of coal a year.

In 1985, the vice-minister noted, the locally run mines supplied the state with 85 million tons, two times that of the preceding 5 years.

He said that with fixed assets of over 20 billion yuan (about 740 million U.S. dollars), the locally run mines and pits now employ 3.5 million people and they have prepared for the growth of regional economy.

But he pointed out that much remains to be done to further develop the locally run mines and pits. Measures should also be taken to stop indiscriminate cutting of resources, he added.

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CSO: 4010/46

LOCALLY RUN MINES TO INCREASE OUTPUT IN NEXT 4 YEARS

OW110722 Beijing XINHUA in English 0552 GMT 11 May 87

[Excerpt] Beijing, 11 May (XINHUA)--China's locally-run mines and pits are to cut 100 million tons of coal in the coming 4 years, a senior Chinese coal official said here today.

Addressing an on-going national meeting on such coal mines, Hu Fuguo said that of the mines run by local governments, 983 mines could add 25 to 30 million tons by 1990 by tapping their production capacity, and the same amount could be cut by 341 more mines after they complete their expansion and upgrading.

"By 1990, these mines may cut 210 million tons of coal," he said.

Locally-run mines are owned and operated by local governments, townships and even individuals. China now has 65,000 such mines and last year they cut 467 million tons of coal, accounting for 52.2 percent of the national total.

At present, coal, the country's major source of energy, accounts for 70 percent of the national energy resources.

Of the mines owned by small towns, the vice-minister pointed out, 4,310 mines have finsihed technological upgrading and as they have an exploitable reserve of 5 billion tons, they will produce over 70 million tons in 4 years.

Another 5,140 township mines that are now being renovated, are expected to turn out 130 million tons by 1990.

In addition, six small coal-producing zones will be developed in Gansu, Shaanxi, and Hebei provinces and the Inner Mongolia Autonomous Region, and they are expected to produce 15 to 20 million tons.

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CSO: 4010/45

## NEI MONGGOL PROVIDES UPDATE ON MINE DEVELOPMENT

SK300030 Hohhot Nei Monggol Regional Service in Mandarin 1000 GMT 28 Apr 87

[Excerpts] Preparations for and construction of a group of large coal mines in our region are being stepped up, and the prospects for coal production are bright.

Our region has abundant coal resources. At present, verified coal-bearing areas have reached more than 100,000 square km, the accumulative proven deposits exceed 216.97 billion tons, accounting for more than one-fourth of the verified deposits in the country, and prospective deposits may reach 1.2 trillion tons, ranking second in the country, next only to Xinjiang. The geological structure of most coal deposits is simple and thick, and the seams are comparatively more stable and can be mined opencast easily. In addition, the quality of the coal is good, and varieties complete. The party and state have paid great attention to the development and utilization of the coal resources of our region. Through many years of construction, the region has built eight collieries whose products come under unified state distribution, and 81 local state-owned collieries. A great number of township and private collieries have also emerged over the past few years. Thus, an initial coal industrial network has been established with an annual raw coal output of more than 35 million tons, ranking ninth in the country.

Since the 3d Plenary Session of the 11th Party Central Committee, the state has designated our region a key area for energy development. Its investment in our region's coal development over the past 8 years amounts to 40 percent of the total investment after liberation. The central authorities have made arrangements for the development of our region's vast coal-bearing areas. The Yiminhe, Huolinhe, Yuanbaoshan, and Jungar coal fields, four of the five large opencut coal mines of the country, whose coal seams need little stripping, are easy to mine. Located near the energy-consuming centers of northeast and north China, they are important energy supply bases of the future.

During the Seventh Five-Year Plan period, a large opencut colliery with an annual output of 10 million tons will be built in Yiminhe, and two opencut collieries will be built in Huolinhe with a production capacity

of 37 million tons. Preparations for the construction of the Yuanbaoshan opencut mine is being carried out vigorously. The pre-phase preparatory projects for the Jungar coal field which plans to exercise unified management of coal, electricity, and road construction industries are also being stepped up. The new method in which the state builds the roads and the masses run the collieries will be adopted in building large, medium-sized, and small coal pits and opencut mines in the Dongsheng mining area whose deposits account for 60 percent of the region's total. It is expected that the region's raw coal output may reach 63.3 million tons by 1990, and may exceed 100 million tons by the end of this century.

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CSO: 4013/72

## BRIEFS

SHAANXI TO OPEN NEW STRIP MINE--Xi'an, 6 May (XINHUA)--Northwest China's Shaanxi Province will open a strip mine at Shenfu coal field next year, a local official said today. Jiang Luowei, representing China's Huaneng Coal Corporation, said, "All preparations for the Huojitu strip mine will be completed this year." "The new mine, with deposits of 580 million tons, is expected to start production in 1991 or 1992 and has an estimated annual output of 3 million tons," Jiang added. "The Shenfu coal field has already received orders totalling 6.3 million tons of high-grade coal a year from domestic and foreign buyers," Jiang said, adding that Shenfu's existing mines can only supply 3 million tons annually. "To meet the growing demand, the project has been moved up from its original starting time scheduled during China's Eighth Five-Year Plan period (1991-1995)," Jiang added. [Text] [Beijing XINHUA in English 0533 GMT 6 May 87] /9604

MORE THERMAL PLANTS TO USE GANGUE--Beijing, 20 May (XINHUA)--China will invest 40 million yuan (U.S.$10.8 million) to construct power plants which will use coal gangue as fuel. Coal gangue is the material which surrounds a vein of coal, and used to be discarded as a waste product after the coal was extracted. Today's CHINA COAL NEWS, a Beijing-based newspaper, reported that construction of seven plants designed to have a combined generating capacity of 108,000 kilowatts will begin this year." Over the past 2 years, China has built 19 similar thermal power plants with a combined installed capacity of 170,000 kW, the paper reported. Last year alone, they generated 433 million kWh of electricity, making profits of 8.82 million yuan (U.S.$2.38 million). They burned 1.3 million tons of coal gangue, which meant that they saved 470,000 tons of better coal that would have been required for the same amount of electricity produced." According to the report, the new plants will be built in Heilongjiang, Liaoning and Yunnan provinces, which all boast plentiful coal deposits. [Text] [Beijing XINHUA in English 1300 GMT 20 May 87] /9604

CSO: 4010/48

BOHAI AREA BECOMING KEY OIL PRODUCTION BASE

OW300941 Beijing CHINA DAILY in English 2 May 87, p 1

[Summary] The area along northern China's coast is being developed into a leading oil and gas producer, XINHUA reports.

The "Bohai Economic Ring" covers 200,000 sq km along the coast of the Bohai Sea, where proven oil reserves account for about half of the country's total.

More than 120 oil zones have been found, and already producing are five oil fields--Shengli in Shangdong Province, Liaohe in Liaoning, North China in Hebei, Dagang in Tianjin and the offshore oil field on the Bohai Sea.

Last year, these produced more than 371 million bbl of crude oil, and are expected to furnish half of the national output by 1990, according to a spokesman from the Ministry of Petroleum Industry.

China began looking for oil in the area in the early 1960s, and work will be intensified during the current Seventh 5-Year Plan (1986-1990) period, the spokesman said.

The shallow sea and beaches cover more than 10,000 sq km, where a dozen oil-bearing strata have been discovered, the spokesman added.


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CSO: 4010/43

## DAQING ENTERS SECOND DECADE OF STABLE PRODUCTION

Beijing KEJI RIBAO in Chinese 5 Apr 87 p 1

[Text] Daqing, 3 Apr (KEJI RIBAO)--According to a recent report by special reporter Liu Yihan and reporter Qiu Chengli, the Daqing oil field has successfully reached its 1975 10-year production goal and is now marching forward along the path of its second 10-year production plan. In 1986, Daqing oil field produced 55.5524 million tons of crude oil, thus exceeding its first 50-million-ton production goal for the second 10-year period.

Relying on advanced technologies to achieve long-term stability in production has been the firm policy at Daqing oil field for many years. During the initial stage of development (1960-1964), Daqing had adopted a development policy aimed at stability and efficiency in oil production; it had initiated 10 major experimental programs which produced 11,422 research accomplishments, of which 144 had significant scientific value, and 4 received national invention awards.

During the period of low-water production (1965-1972), the oil field initiated studies of water injection and oil extraction by layers, and found a satisfactory solution to the problem of removing water from crude oil. During this period, a total of 11,233 research accomplishments were reported, 254 of which were of significant scientific value.

During the medium-water production period (1973-1980), Daqing initiated a number of basic research programs to study the development of oil fields by water injection, and established a curriculum of studies including oil field geology, fluid mechanics between oil layers, and oil reserve engineering. It also conducted experiments to gain experience toward increased productivity and higher production stability. Since 1976, it had set a goal of maintaining a production level of 50 million tons annually for 10 years. During the 8-year period, it reported a total of 15,573 research accomplishments, of which 434 were significant scientific value; they played an important role in maintaining production stability during this period.

During the high-water production period (since 1981), it applied a system engineering approach which took into consideration Daqing's unique geological conditions and extraction methods to maintain high production level; the oil field was reorganized into many departments and many disciplines. After 5

years of dedicated efforts, 4,622 research accomplishemnts were reported, of which 340 were of significant value, and 8 received national awards. They not only played an important role in achieving the goal of "stable production at 50-million ton level," but also layed the technical foundation for extending the production period and increasing the production efficiency.

The annual production of petroleum from the Daqing oil field is approximately half of China's total production. Today, the oil field is about to enter the super-high water production stage; some of the older oil fields have been mostly flooded, productivity of the oil wells is dropping rapidly, and the number of pipe failures in the oil/water wells is on the rise. Faced with these difficulties, engineers and technicians at the Daqing oil field are exploring different ways to maintain stable production for another 10 years. The results of a feasibility study show that there is sufficient oil in the ground to maintain production for another 10 years. Because of the rapid advance in oil extraction technology, many low-penetration layers and thin layers which were previously considered non-productive and therefore excluded from reserve estimates are now considered to have extraction value. A revised calculation in 1985 showed that the estimated reserves for three of the old oil fields, Lamatian, Saertu, and Xingshugang had increased 62.4 percent from a 1978 estimate. In addition, there are many new oil fields to be developed in order to meet the long-term production requirement. Also, from the experience of the first 10-year period, the oil field has developed a series of new water injection techniques and acquired large amount of first-hand data on various stages of oil/water distribution and movement.

In order to achieve the production goal for the second decade, Daqing still considers technological advance as its top priority. In 1986, the main targets of research and development were to increase the water-driven reserves, to increase the productivity of low-penetration layers, and to conserve energy consumption. As a result of a joint organized effort by party officials, scientists and engineers, and technicians, 1986 produced more than 800 technical innovations and 131 applications of new techniques and new procedures. They provided the technical background to ensure the success of the second decade of 50-million ton annual production level.

3012/9274
CSO: 4013/64

## TWENTY-SEVEN OIL-BEARING STRUCTURES VERIFIED IN BOHAI

Beijing KEJI RIBAO in Chinese 5 Apr 87 p 1

[Text] 4 Apr (XINHUA)--China's Bohai oil field has entered a stage of sustained production while oil exploration continues.

The Bohai oil field began exploration and production in 1965 in a joint effort with other countries. Today, more than 200 wells have been drilled in the Bohai Bay and 27 oil-bearing structures have been identified. The prospect for future production is excellent.

The Chengbei oil field developed under Sino-Japanese cooperation is the first off-shore oil field that has entered commercial production since China began joint exploration with other countries. The two drilling platforms are now standing in the Bohai. By June of this year when this oil field will be in full production, the annual patroleum production will reach 400,000 tons. During the joint exploration, a group of promising oil-bearing structures were discovered, of which the BZ 28-1 oil field is expected to go into production by September of next year.

The Bohai Petroleum Co has also opened up a region in Biaodong Bay reserved for China's own exploration and development. Over the past few years, 14 test wells have been drilled, and two had promising structures. The company has also entered into agreements with dozens of foreign companies for economic and technological cooperation. It has actively imported and absorbed advanced technologies from abroad in order to raise its own management and technical standards; in more than 20 technical areas including data processing using large-scale computers and assessment of oil and gas reserves, it has reached or approached international standards. In the development of the Chengbei oil field, Chinese technicians took less than a year to learn the operation, production, and maintenance procedures of the petroleum platforms, and began independent management ot the high-technology off-shore oil-drilling system. For the first time, they have accepted the responsibility as prime contractor developing the BZ 28-1 oil field. In addition, they have provided teams of key technical personnel and transferred advanced technologies to other domestic oil companies; last year, they began sending engineering teams to the international oceanic engineering contracting market, and received favorable comments from the host countries.

3012/9274
CSO: 4013/64

MORE DEEP DRILLING, WATER INJECTION NEEDED TO MAINTAIN FLOW

OW060642 Beijing XINHUA in English 0615 GMT 6 May 87

[Text] Beijing, 6 May (XINHUA)--China will focus [a major] effort to better utilize oil deposits over the next few years to boost output to 1.05 billion barrels by 1990.

According to today's ECONOMIC DAILY, China has achieved stable increases in oil output since 1984, and pumped 917 million barrels last year, 42 million more than in 1985."

A recent international survey shows China now ranks fifth in the world in terms of petroleum output, the report said.

"During the country's Seventh Five-Year Plan period (1986-1990), China will step up oil exploration and locate more high-quality crude oil reserves," Wang Tao, minister of China's petroleum industry, said, "and tapping new wells will be the focus of exploration, while oil-rich zones in the east and west must be fully utilized."

According to surveys, rich oil deposits are under the northern part of the Tarim Basin in northwest China's Xinjiang Uygur Autonomous Region, and three exploratory wells struck oil early this year. A drilling rig capable of a depth of 9,000 meters started operation in the area last month.

To date, 10,000 geologists are working in the area to the northeast of the Jungar Basin and in the center of Taklimakan Desert conducting overall geological exploration.

"Existing oil fields in other regions must also tap available resources to increase crude oil output," the minister said, adding water should be injected into oil wells to maintain the pressure of oil-bearing rock formations.

"New fields such as Liaohe, Shengli, Zhongyuan, and Dagang must speed development to expand production capacity," the paper stressed, "and China should also emphasize the further development of natural gas resources."

"The country's rich resources of natural gas have not been fully tapped," the minister said, adding more reserves should be located in Sichuan, in the border areas of Shaanxi and Gansu provinces and the Ningxia Hui Autonomous Region, and in the Liaodong Gulf and Yingge Sea.

"Natural gas supplies in Sichuan, Beijing, and Tianjin will increase with the further development of a group of major natural gas producers," he said.

"Oil and gas resources should also be developed in old revolutionary base areas, regions inhabited by China's ethnic minority groups, and in remote underdeveloped areas to promote the country's economic development," the paper said.

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CSO: 4010/45

TARIM BASIN EXPLORATION TO BE INTENSIFIED

HK090742 Beijing CHINA DAILY in English 9 May 87 p 1

[Article by staff reporter Xu Yuanchao]

[Text] Oil exploration will be accelerated in the Tarim Basin in northwest China's Xinjiang Uygur Autonomous Region in an effort to discover new reserves during the current five-year plan (1986-90).

An official from the Ministry of Petroleum Industry said 10,000 geologists were working in the basin, which covers 560,000 square kilometres and includes the 330,000-aquare-kilometre Taklimakan Desert.

Wang Shenyang, deputy director of the ministry's exploration department, told CHINA DAILY the ministry plans to drill five to six test wells in the Tarim Basin this year. One is planned for the Taklimakan Desert, where the weather is changeable and transportation poor.

Seven seismic survey teams--about 1,000 people--have been sent to work in the desert, where they have discovered several large uplifts.

The uplifts were found in the centre of the basin and along the northern part of the Tarim River. Geologists think there will be rich oil deposits under them. But Wang said it was premature to predict whether the reserves would be of oil or natural gas or how large they would be.

According to the ministry, three exploratory wells struck oil early this year. A drilling rig capable of reaching a depth of 9,000 metres started operation in the area last month.

To date, nearly 100 test wells have been drilled and 40,000 kilometres of seismic survey lines have been laid in the area.

Wang said, "The Tarim Basin, which has good geological conditions for oil and natural gas, has attracted the interest of both Chinese and foreign oil companies."

In the past, China had no ability to explore for oil in the desert. It needed up-to-date technology and equipment. But the investment needed for oil development will still be "staggering," he said.

"We only developed marginal areas of the basin, such as in Yecheng, where we found an oilfield with 20 million tons of oil reserves and 20 billion cubic metres of natural gas," Wang added.

The ministry plans to build a 150,000-ton-a-year old refinery and a 60,000-ton-a-year chemical fertilizer factory near the 25-square-kilometre oilfield.

Ninety percent of China's crude oil output is in the eatern part of the country. The oil industry will focus one-third of its efforts on better use of oil reserves there over the next few years to boost its output to 150 million tons by 1990.

China produced 131 million tons of crude oil last year, a 4.6 percent increase over 1985, according to the ministry.

The discovery of new oil reserves in the Tarim Basin has become a matter of increasing importance to the overall planning and strategy of China's oil industry, Wang said.

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CSO: 4010/45

## BRIEFS

SHENGLI SETS NATIONAL RECORD--Jinan, 14 May (XINHUA)--A drilling team in the Shengli oil field, the second largest in China, drilled two wells exceeding 3,000 meters each in 1 month, a national record. The No 32408 drilling team was honored with the title "Drilling Team With Meritorious Service in Drilling Deep Wells Scientifically" Tuesday. The drilling team, which was awarded the gold medal in 1986 by the Ministry of Petroleum Industry, accomplished the deeds between 8 April and 8 May in an area around the Bohai Sea. More than 80 drilling teams are working there and, over the past 2 months, they drilled five wells, each producing more than 700 barrels of oil a day. Over the past few years, Shengli, which produced 206.5 million barrels last year, found many oil-bearing structures, tripling the originally verified reserves of 1980. It plans to boost its output to 350 million barrels by 1990. [Text] [Beijing XINHUA in English 0140 GMT 14 May 87] /9604

CSO: 4010/48

## NUCLEAR POWER INDUSTRY PREPARES TO ENTER INTERNATIONAL MARKET

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 12 Dec 86 p 3

[Article by staff reporter Zhang Heping [1728 0149 1627]: "China's Nuclear Power Industry Expands Foreign Economic Ties--Metallic Calcium and Other Exports Comprise One-Quarter of World Trade Volume--Uranium Mine Exploration and Other Projects Being Negotiated With Foreign Companies"]

[Text] The direction of "civil and military integration" being implemented by the nuclear power industry, one of the Chinese military industries, is vigorously expanding foreign economic trade cooperation, promoting the products of the nuclear power industry on the international markets.

According to what Ke Ziaoning [2688 1420 1380], Deputy General Manager of the China Atomic Energy Industrial Corporation, disclosed, presently the exports of the nuclear power industry's technology and products have initially opened up new prospects. A long-term supply contact of almost U.S. $200 million has been signed with the Federal Republic of Germany and France for one of the major export products of this corporation. More than 3000 tons of another export products, metallic calcium, used in steelmaking and lead smelting, has been exported to more than 10 countries and regions, including the United States, Europe, Japan, and Australia, comprising about one-quarter of the yearly world trade volume in metallic calcium.

Foreign economic and technical cooperation has also made encouraging progress. The first technical-type joint capital enterprise of the Ministry of Nuclear Industry with foreign cooperation, a joint venture contract to produce magnetic flowmeters with joint capital from the Shanghai Guanghua Instrument Factory and the Altomeier Company of the Federal Republic of Germany, was formally signed recently.

In regard to imports, one of the key construction projects of the nuclear power industry the Qinshan nuclear power plant, has imported equipment and technology from abroad, of which the nuclear island portion of equipment which arrived only this year has reached more than U.S. $40 million. For example, the pressurized reactor shell imported from Japan has already been shipped to Shangahi. The heart of the nuclear island, the main pump, is awaiting shipment from the Federal Republic of Germany.

The Deputy General Manager said that in the future, the Atomic Energy Corporation will be making great efforts to open up exports of mechanical and electrical products. Export products will include marble, granite and other building materials. This corporation has imported form Italy five processing production lines with an annual production of 200,000 square meters, and three of them have now gone into production.

When asked about which economic cooperative projects were being carried out up to the present time, Ke Ziaoning disclosed that this corporation was exploring for and developing uranium mines, jointly producing photoelectric multipliers, importing lithium batteries, fire alarm production technology, and other projects, and negotiating with companies from Japan, Switzerland, the Federal Republic Germany, and other countries.

Deputy Manager Ke indicated that in the future China's nuclear power industry will vigorously participate in all kinds of exhibit and sales activities. He said that at the World's Invention Fair held in Brussels, China's nuclear power industry brought out a mini-reactor of it own design, a hollow cement plate shaping extruder, and other technical products. This is the first time that China's nuclear power industry has gone abroad and taken part in an exhibition in the more than 30 years since its establishment.

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CSO: 4013/31

## BRIEFS

DAYA BAY UPDATE--Shenzhen, 8 May (XINHUA)--The first two generating units at the Daya Bay nuclear power plant in Shenzhen, Guangdong Province, will begin operating in August 1992 and April 1993, [respectively] an official announced here today. Zhan Yunlong, general manager of the Guangdong Nuclear Power Joint Venture Company, said construction of the station is proceeding according to schedule. "We're training operators and drawing up plans for emergency cases," he said, pledging to strictly abide by international standards of safety and quality in building the plant. Preparations are now under way to establish a government office to oversee the station's safety and quality. [Text] [Beijing XINHUA in English 1518 GMT 8 May 87 OW] /6662

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